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Invention: A SYSTEM FOR MANUFACTURING CONTAINERS, IN PARTICULAR FOR PRESERVING FOOD PRODUCTS

Inventor(s): BOLDRINI, Fulvio
GHIOTTI, Roberto
CAVALALRI, Stefano

Harbin King & Klima
500 Ninth Street SE
Washington DC 20003
202-543-6404 Voice
202-543-9230 Fax

This is a:

- ☐ Provisional Application
- ☐ Regular Utility Application
- ☐ Continuing Application
  ☐ The contents of the parent are incorporated by reference
- ☒ PCT National Phase Application
- ☐ Design Application
- ☐ Reissue Application
- ☐ Plant Application

SPECIFICATION

This application claims priority to Italian Patent application number BO 2002A 000484, filed July 25, 2002, which is incorporated by reference herein.

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Description

A system and a method for manufacturing containers, in particular for preserving food products

Technical Field

The present invention relates to a system for the manufacture of containers, in particular for preserving food products, of which the characterizing features are as recited in claim 1 appended.

The invention relates also to a method of manufacturing containers, in particular for preserving food products, of which the essential features are as recited in the preamble of claim 30 appended.

Background Art

More particularly, the invention finds application in the art field concerned with the manufacture of containers such as bottles and cartons and the like, having a structure fashioned from multilayer or coated paper material and utilized for packaging liquid foods or edible products in general, typically milk, fruit juices, yoghurt, mineral water and other such substances.

It is common practice for containers of the type in question to be manufactured on a system consisting in a number of separate machines by which a selected

forming material can be fashioned into a succession of single containers or bottles ready for filling.

The forming material is processed generally by machines that need to be equipped with respective storage units, so that the material emerging from a given machine can be held temporarily before being transferred to the machine on which the next step of the manufacturing process will be performed.

The need to provide a succession of storage units is dictated by the appreciable distance that separates the various machines utilized in the container manufacturing process, and heightened by the different rates at which the forming material advances when transferred from one machine to another. Indeed the strategy adopted in order to be certain that each machine will receive a steady supply of material is to ensure that the relative storage units, positioned normally upstream and downstream of the machines, are maintained as a rule at full capacity in order to avoid repeated stoppages that would otherwise be caused by a lack of material on the infeed side.

It will be appreciated also that the manoeuvres involved in transferring the forming material from one machine to another are performed typically by one or more operators, whose main task is precisely that of minding the storage units.

Notwithstanding the merits of the container manufacturing process outlined above, which affords considerable output potential, there are certain

drawbacks attached, principally regarding the overall dimensions and the cost of the manufacturing system, also the speed with which the containers are turned out and the continuity of the process generally.

More exactly, the presence of a succession of machines separated one from another with relative storage units located between one machine and the next dictates that a large area is needed solely in order to accommodate the system and its minimum operating space, that is to say the space needed to ensure optimum movement of the parts associated with each machine and the material transferred from one machine to the next, and the space in which the operators employed to oversee the running of the process can carry out their various tasks.

Naturally, the system described above is typified by notably high commissioning and operating costs, in view both of the continuous maintenance requirements generated by a plurality of separate machines, and of the space needed to accommodate them.

Another consideration is that, by its very logistical nature, the manufacturing system outlined above does not allow operation at particularly high tempos, being subject to frequent pauses attributable to the switches between machines in operation on the one hand, in which the forming material is processed while advancing through the machine, and storage units on the other, in which the material is simply deposited for a given duration in readiness for its transfer to another machine.

The slowing down and frequent interruptions of the manufacturing process do nothing to help reduce the already high overheads, with the result that the end product is penalized by high marketing costs, and these same costs are driven up further by the need to employ operators exclusively for the purpose of transferring the forming material from one machine to another, a task that tends over time to become quite tedious.

The principal object of the present invention is to overcome the drawbacks typical of the prior art, by providing a system for the manufacture of containers, in particular containers for preserving foods, such as will incorporate all of the work stations needed to produce the selfsame containers, guaranteeing compact dimensions overall, achieving a reduction in the costs of producing and the costs of marketing the containers, while continuing to ensure optimum quality of the end product.

Another object of the invention is to speed up the processes by which the container is manufactured, and ensure their continuity.

A further object of the present invention is to automate the manufacturing process and thus relieve operators of tedious tasks like transferring the forming material from one machine to another, so that their activity can be confined to the conventional procedures of controlling, running and/or servicing the system.

Disclosure of the Invention

These objects and others besides, which will emerge more clearly from the following specification, are substantially realized in a system for manufacturing containers, in particular for preserving foods, of which the characterizing features are as recited in claim 1 appended.

In addition, the stated objects are realized according to the present invention in a method of manufacturing containers, in particular for preserving foods, of which the characterizing features are as recited in claim 30 appended.

The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

-figure 1 is a schematic illustration of a system for manufacturing containers according to the present invention, viewed in plan;

-figure 2 is a further schematic illustration of the system of figure 1, viewed in elevation;

-figure 3 shows a continuous strip of forming material with a bonding edge utilized by the system of figures 1 and 2, illustrated fragmentarily in perspective and in a first possible embodiment;

-figure 4 shows a continuous strip of forming material with a bonding edge utilized by the system of figures 1 and 2, illustrated fragmentarily in perspective and in a second possible embodiment;

-figure 5 is a sectional illustration of a container fashioned from the continuous strip of figure 3;

-figure 6 is a sectional illustration of a container fashioned from the continuous strip of figure 4.

With reference to the drawings, 1 denotes a system, in its entirety, for manufacturing containers in accordance with the present invention.

As indicated in figure 1, the system 1 comprises a supporting structure 2 and, associated with this same structure, a forming sector 3 serving to prepare at least one blank 4 from which to fashion a relative container 5, also a shaping sector 6 operating downstream of the forming sector 3, of which the function is to fold the single blanks 4 emerging from the forming sector 3 and establish the shape of the respective folded containers 5 by means of a fixing operation.

In particular, and referring to figures 1 and 2, the forming sector 3 comprises a feed station 7 by which a continuous strip 8 of forming material 9, suitable for preserving liquid food products, is directed along a predetermined feed path A. The forming material 9 will consist preferably of a multilayer or treated paper material, such as paperboard or cardboard coated with an impermeable and antiseptic film, typically polyethylene.

The aforementioned continuous strip 8 of forming material 9 is preferably carried by and decoilable from a main reel 10 of the feed station 7 rotatable about a relative longitudinal axis X.

As discernible in figure 2, the feed station 7 also comprises at least one auxiliary reel 11 rotatable

likewise about a relative longitudinal axis Y, from which a relative second strip 12 is decoiled.

The continuous strip 12 decoiled from the auxiliary reel 11 can be spliced in conventional manner to the strip 8 decoiled from the main reel 10, thereby ensuring that the system 1 is guaranteed a continuous supply of forming material 9. In practice, the two continuous strips 8 and 12 will be joined whenever the strip 8 or 12 currently in use is nearing depletion.

More exactly, the trailing end of the continuous strip 8 or 12 currently in use will be cut and spliced to the leading end of a new roll of strip 8 or 12 carried by another reel 10 or 11.

To advantage, each reel 10 or 11 is interchangeable with another reel 10 or 11, so that when the strip 8 or 12 is fully depleted, the empty reel 10 or 11 can be replaced with a full reel 10 or 11.

Still referring to figures 1 and 2, the feed station 7 also comprises a plurality of guide elements 13, consisting preferably in guide rollers, serving to establish a first leg B of the feed path followed by the forming material 9 that extends externally of the supporting structure 2 of the system 1, along a direction substantially parallel to the longitudinal dimension of the selfsame supporting structure.

The system 1 further comprises a traction device 14 operating downstream of the feed station 7, by which the strip 8 or 12 of forming material 9 is taken up

directly and drawn from the respective reel 10 or 11 over the aforementioned guide elements 13.

In particular, the traction device 14 comprises a pair of pinch rolls 14a positioned mutually tangential and establishing a passage 14b through which the forming material 9 is routed by the guide elements 13 of the feed station 7.

To ensure the correct feed motion of the forming material 9, at least one of the two pinch rolls 14a of the traction device 14 is coupled to drive means of conventional embodiment (not illustrated) and thus power driven, so that the forming material 9 located upstream of the traction device 14 will be drawn from the respective reel 10 or 11.

Still referring to figure 2, the system 1 can be equipped with a numbering device 15 serving to mark consecutive portions of the forming material 9 at points coinciding with the single blanks 4. The numbering device 15 operates between successive guide elements 13 of the feed station 7 in such a way as to mark the forming material 9 at a point along the feed path where the strip extends substantially in a horizontal plane.

The system 1 also comprises a tensioning device 16 positioned and operating upstream of the traction device 14, in such a way that the segment of the forming material 9 advancing downstream of the selfsame device 16 is tensioned longitudinally in order to facilitate certain operations carried out along the first leg B of the feed path A, typically

those by which the forming material 9 is creased or scored and then cut into blanks, as will be described in due course.

As indicated in figure 2, the tensioning device 16 comprises at least one pair of pinch rolls 16a positioned mutually tangential and establishing a passage 16b through which the strip of forming material 9 is routed by the guide elements 13 of the feed station 7.

In a preferred embodiment, at least one of the two pinch rolls 16a of the tensioning device 16 is subjected to a braking action when in rotation, such as will oppose the action of the traction device 14 and tension the forming material 9 longitudinally along the segment downstream of the device 16, as mentioned above.

As indicated likewise in figure 2, the system 1 can include a sterilizing device 17 operating along the first leg B of the feed path A followed by the advancing strip, of which the function is to debacterialize the forming material 9.

More exactly, the sterilizing device 17 comprises at least one ultraviolet lamp 17a directed at a substantially horizontal segment of the forming material 9 extending between the tensioning device 16 and the traction device 14.

The sterilization of the forming material 9 might nonetheless be carried out employing any given method and utilizing any conventional sterilizing device. For example, the ultraviolet sterilization method

mentioned above might be replaced or supplemented by a sterilization step involving exposure of the forming material 9 to substances such as ozone and/or peroxide agents of various types.

Still in figure 2, the forming material 9 decoiling from the reel 10 or 11 currently in use is also subjected to the action of a finishing device 22 operating between the tensioning device 16 and the traction device 14, upstream of the sterilizing device 17. The finishing device 22 operates on a bonding edge 4b of the advancing strip 8 or 12, and serves to prepare the selfsame edge 4b in such a way that it can be positioned safely on the inside of the formed container 5.

The term "bonding edge" is used to indicate a free lateral edge of the advancing strip 8 or 12, hence a free longitudinal edge of each blank 4 cut from the strip, along which a sealing or welding operation is performed to establish the shape of the resulting container 5, at least in part.

In short, the bonding edge 4b constitutes a fixing portion of each blank 4 such as will combine with the main body of the blank in overlapping contact to establish a sealable or weldable area.

In accordance with a first embodiment of the invention (figure 3), the finishing device 22 might comprise seam-folding means (not illustrated) by which the bonding edge 4b can be bent double longitudinally along its length so that a treated portion of the forming material, having the required

properties of hygiene and impermeability, will remain on the inside of the container 5 (figure 5).

To this end, the finishing device 22 might also comprise fixing means (non illustrated) consisting preferably in one or more sealing or welding devices, such as will secure the bonding edge 4b in the folded position before the material is directed into a further processing station.

In accordance with a second embodiment of the invention (figure 4), the finishing device 22 might comprise application means (not illustrated) by which to lay a fillet 23 of treated material along the bonding edge 4b of the advancing strip 8 or 12, so that the raw edge of the material 9 will be covered by a portion of treated material having the required properties of hygiene and impermeability, positioned on the inside of the container 5 (figure 6).

As illustrated in figures 1 and 2, the forming sector 3 comprises a scoring station 18 positioned downstream of the feed station 7, and more exactly, immediately downstream of the traction device 14, by which each portion of the forming material 9 destined to provide a relative blank 4 is impressed with at least one crease line 4a.

In the example of figure 2, the scoring station 18 comprises at least one press 18a presenting mutually opposed dies 18b offered to the two faces of the forming material 9. In operation, the press 18a will alternate between an idle position in which the two dies 18b are distanced from the forming material 9

interposed between them, and an operating position in which they are brought together forcibly against the forming material 9 in such a way as to generate the crease line, or lines 4a.

As an alternative solution to the press 18a, the scoring station 18 might comprise at least one pair of tangentially placed rollers (not illustrated) operating from either side on the advancing strip of forming material 9. To produce the crease lines 4a, a first roller will afford one or more projections designed to indent the structure of the forming material 9, whilst a second roller or reaction roller will present grooves corresponding in number and matched positionally to the projections presented by the first roller, so that each projection engages a respective groove.

The forming sector 3 also comprises a cutting station 19 operating downstream of the scoring station 18, by which the creased forming material 9 is taken up from this same station 18 and divided into successive discrete pieces, each constituting a respective blank 4. The cutting station 19 comprises at least one blade 19a positioned to operate in close proximity to the scoring station 18 so that the forming material 9 can be cut immediately adjacent to the press 18a. In operation, like the press, the blade 19a alternates between an idle position distanced from the forming material 9, and an operating position of engagement with the selfsame material 9, in which the strip is cut transversely.

To advantage, the blade 19a can be timed to alternate between the idle position and the operating position synchronously with the movement of the press 18a of the scoring station 18 between the idle position and the operating position, so that the press 18a and the blade 19a are made to engage the forming material 9 simultaneously.

As discernible from figures 1 and 2, the forming sector 3 further comprises at least one transfer device 20 by which each blank 4 emerging from the cutting station 19 is carried toward the shaping sector 6 where it will be fashioned into a relative container 5. In the example illustrated, the transfer device 20 comprises a conveyor belt 20a, and one or more gripper elements 20b associated with the belt, such as will take up each blank 4 from the cutting station 19 and accompany it along the belt 20a.

The conveyor belt 20a will extend preferably in a direction perpendicular to the first leg B of the feed path A, establishing a second leg C extending externally of the supporting structure 2, along which the forming material 9 is directed.

At a given point on this same second leg C of the feed path A followed by the forming material 9, the system 1 is equipped with a prefolding station 21 by which blanks 4 emerging from the cutting station 19 are bent initially along the crease lines 4a made at the scoring station 18. In particular, the function of the prefolding station 21 is to bend the structure of each successive blank 4 conveyed from the cutting

station 19 toward the shaping sector 6 by applying one or more mechanical actions such as will deform the material slightly along the crease lines 4a.

More exactly, the step of prefolding each blank 4 is performed by one or more movable folder elements (not illustrated) operating in conjunction with a corresponding number of reaction elements (likewise not illustrated). The folder elements will force the relative portions of the blank 4, whilst the reaction elements will restrain the adjacent portions so as to weaken the structure of the blank 4 along the crease lines 4a extending between the forced and restrained portions.

As discernible in figure 1, the shaping sector 6 comprises a folding station 24 operating downstream of the transfer device 20, where each blank 4 is bent along the longitudinal crease lines 4a in such a way as to take on the shape of a relative container 5, at least in part. In practice, the folding station 24 will be equipped with a set of folder elements (not illustrated) designed to operate on the blanks 4 in combination with one or more reaction elements (not illustrated), for example mandrels of substantially cylindrical geometry, around which the blank 4 is wrapped in such a way as to assume a substantially tubular configuration rendered stable ultimately by fixing the bonding edge 4b to the corresponding part of the blank 4.

The shaping sector 6 further comprises a sealing or welding station 25, located downstream of the folding

station 24, at which each blank 4 acquires the definitive shape of the container being manufactured. The station 25 in question is furnished preferably with additional folder elements (not illustrated) set up to operate on one end of each tubular blank 4, by which the bottom of the container 5 is formed, and at least one sealer or welder (not illustrated) acting on portions of each container 5 that may require one or more sealed or welded joints.

In the example of figure 1, the shaping sector 6 also incorporates at least one assembly device 26 of which the function is to apply a neck 5a to one end of each tubular blank 4 emerging from the folding station 24.

The neck 5a is fixed to the tubular structure of the folded blank 4 at one end, opposite to the end functioning as the bottom of the container 5. With this purpose in view, it is preferable that the sealing or welding station 25 will include at least two units equipped with respective sealers or welders set up to engage the neck 5a, where this is attached to the main body of the blank 4, and to engage other parts of the container 5 such as the bottom.

It will also be observed that the system described thus far, which is designed to prepare blanks 4 from a continuous strip of forming material 9, might operate equally well with forming material 9 procured as a flat tube that can be scored and cut to generate a succession of blanks 4 in similar fashion to the strip forming material 9, or a material having some

other initial structural configuration. In this case, naturally enough, the system might present certain differences from the example illustrated, especially in the area of the folding station 24, where the folding steps would be replaced by an erecting step in which the blanks 4 are subjected to a lateral compressing action applied in such a way that the flat profile opens out into a tubular configuration, or in the area of the sealing/welding station 25, where the operation and structure of the sealing or welding equipment will depend exclusively on the type of procedure needed to complete the erection of the blank 4.

With reference to figure 1, the shaping sector 6 establishes a third leg D of the feed path A followed by the forming material 9, extending externally of the supporting structure 2 and substantially parallel to the first leg B, in such a way that the path A followed by the forming material 9 circumscribes the selfsame structure 2, at least in part, substantially describing a letter "C".

The system thus described might nonetheless present a substantially linear configuration when viewed in plan, with the forming and shaping sectors 3 and 6 aligned along a substantially rectilinear path. In this instance, were the shaping sector 6 to include two or more shaping lines 6a, the forming material 9 would follow a path presenting: a first rectilinear leg extending parallel to the longitudinal dimension of the supporting structure 2; a second leg extending

substantially perpendicular to the first, allowing the transfer of the forming material 9 to any one of the single shaping lines 6a, which are offset from the first leg; and a third leg parallel to the first leg, along which the forming material 9 proceeds in the same direction as followed along the first leg.

The particular layout of the system 1, presenting stations and devices all associated with the supporting structure 2 to create a single, solid and functional assembly, is characterized further by the inclusion of feed means (not illustrated) such as will ensure the forming material 9 can be transferred from one station or device to the next substantially at a predetermined and uniform tempo, thus ensuring the continuity of the manufacturing process.

The operation of the system 1, described thus far essentially in structural terms, is as follows.

With the traction device 14 activated and running, the system 1 will proceed initially to form the blanks 4, and thereafter to shape them as appropriate for the selected type of container 5. The process is a continuous one, with no breaks between the steps of forming the blanks 4 and shaping the containers 5.

In more detail, during the process of preparing the blanks 4, the forming material 9 carried by the respective reel 10 or 11 currently in use will be drawn by the traction device 14 along the first leg B of the feed path A toward the scoring station 18.

The material is engaged first by the numbering device 15, which marks the strip at regular

predetermined intervals to identify the portions that will be separated ultimately into single blanks 4.

Next, the forming material 9 is directed through the rolls 16a of the tensioning device 16, which presents a measure of resistance to the advancing motion of the strip, combining thus with the traction device 14 to generate a longitudinal tension that will facilitate the successive steps of scoring and cutting the material 9.

The advancing material 9, and more exactly the face of the material that will be positioned on the inside of the container 5, is then sterilized during the course of its passage from the tensioning device 16 toward the traction device 14.

In addition, and likewise as the forming material 9 is drawn from the tensioning device 16 toward the traction device 14, a finishing operation is performed to the end of preparing the bonding edge 4b that will be positioned on the inside of the relative container 5.

In this step, more exactly, the bonding edge 4b may undergo two different types of preparation. The first consists in folding the edge double longitudinally against the face of the material 9 opposite the face that will be located ultimately on the inside of the container, then flattening and securing the fold to produce a bonding edge 4b of double thickness. The second consists in applying a fillet 23 of treated material to the bonding edge 4b along its entire length, without any fold being made.

After the finishing and sterilizing steps, the forming material 9 proceeds through the passage 14b afforded by the traction device 14 and toward the scoring station 18.

Once a given portion of the forming material 9, corresponding to one blank 4, is located between the dies 18b of the press 18a operating at the scoring station 18, the press 18a will be caused to move from the idle position to the operating position. The two dies 18b of the press 18a are consequently drawn together, impinging forcibly on the interposed forming material 9 and impressing it along a set of predetermined crease lines 4a.

After the forcing stroke, the press 18a will be deactivated and the dies 18b drawn apart to release the forming material 9, which can thus advance beyond the cutting station 19 toward the conveyor belt 20a. On reaching the conveyor belt 20a, the forming material 9 is taken up by one or more gripper elements that will facilitate the operation of cutting through the creased material 9. In effect, as the creased forming material 9 is restrained by the gripper elements 20b of the transfer device 20, the blade 19a of the cutting station 19 is caused to move from the idle position to the operating position, slicing through the material in close proximity to the scoring station 18 and separating the creased portion, now a formed blank 4, from the forming material 9 subsequently inserted between the dies 18b of the press 18a. Advantageously, the forcing stroke

of the press 18a is timed to occur simultaneously with the cutting stroke of the blade 19a, in such a way that each newly creased portion of forming material 9 is separated from the successive portion as the successive portion is creased in its turn.

Each blank 4 formed in this way is transferred along the second leg C of the feed path A and toward the shaping sector 6, passing through the prefolding station 21 in which the blank 4 is bent initially along the crease lines 4a.

The blank 4 now advances along the third leg D to the folding station 24, where it is bent along the crease lines 4a to assume the definitive shape of the selected container 5 at least in part.

Next, the blank 4 undergoes at least one sealing or welding operation as a result of which the shape of the selected container 5 created by bending the blank is fixed and thus made permanent. In the event of the container being fitted with a separately embodied neck 5a, this obviously will be assembled prior to the sealing or welding step and fixed permanently to the body of the container as part of this same step.

All of the sealing or welding steps executed as part of the method described above can be carried out using any given conventional method, which preferably would include heat-sealing, ultrasonic welding and/or induction welding.

The problems associated with the prior art and the stated objects are respectively overcome and realized in accordance with the present invention.

First and foremost, the containers manufactured by the system according to the invention are of optimum quality, both from the structural standpoint and from that of their intended use, namely preserving foods.

Furthermore, the system described and illustrated features a single structure incorporating all of the stations and devices needed to fashion the containers. In particular, the system 1 disclosed is characterized by notably compact dimensions, which result in a considerable saving of space that will also translate into cost savings, unlike solutions typical of the prior art which call for much larger spaces due to the appreciable distances between one station and another and the extensive use of storage units between the stations in which to hold the forming material.

In addition, the containers are turned out quickly and with no interruptions resulting from the need to transfer material from one station to another, as the material is transferred along the feed path A automatically.

It will also be appreciated that single containers are manufactured by the system 1 from start to finish, without the need for any action on the part of operators, who instead can concentrate fully on the procedures of controlling, running and/or servicing the system, which are decidedly less tedious than the repetitive tasks of transferring material from one station to another.